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Economics of Hardwood Pulpwood Production in Appalachia, Ohio

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INTRODUCTION

Forest cover of various kinds comprises half or more of that part of southeastern Ohio included in Appalachia. With such a large forested area, it seems desirable to make an estimate of its possibilities in furnishing economic income to the area.

A previous bulletin[1] published in 1967 dealt with the economics of production of hardwood for sawtimber in southeastern Ohio. The present study will examine the possibilities of hardwood pulpwood production in furnishing economic income in that area. Such a study is important because of the shorter production cycle for pulpwood than for sawtimber and because more and more land in southeastern Ohio is being abandoned to forest cover as farming in that area becomes less and less attractive.

The main difference in approach in the present study dealing with hardwood pulpwood production and the previous study dealing with sawtimber production is that improvement practices, with their costs and production effects, are included. A recent study dealing with costs and yield returns of managed hardwood pulpwood stands has made this possible. These costs and yield return data were included in a recent bulletin[2] by Gansner and Shaudys and are used as basic data for this study.

Without improvement practices, there is clear evidence that hardwood pulpwood production in Appalachia is unprofitable as a complete cycle venture. Tables 1 and 2 give evidence of this. Standing trees were given a value of $4 per cord in calculating income for these tables. Even with double this value, the income would be far below production costs. For this reason the present study was limited to an analysis of costs and income from stands where improvement practices were employed.

Expenses incurred in pulpwood production are: yearly labor costs; taxes; fencing; improvement practice costs; and interest (at both 4% and 5%) on all accumulated investment, including land investment.

[1]Sherman, R. W. 1967. Economics of Sawtimber Production in Appalachia, Ohio. Ohio Agri. Res. and Dev. Center, Res. Circ. 152.

[2]Gansner, D. A. and E. T. Shaudys. 1969. Opportunities for Pulpwood Growing Investment in Southeastern Ohio. U. S. Dept. Agr., Forest Service, Res. Paper NE-151.

TABLE 1.—Estimated Costs and Income for Unimproved Stands of Hardwood Pulpwood in Appalachia, Ohio.

Site Index	Age of Stand in Years											
	10		20		30		40		50		60	
	Cost	Income	Cost	Income	Cost	Income	Cost	Income	Cost	Income	Cost	Income
40	$22	$0	$ 55	$ 1	$101	$13	$171	$ 32	$274	$ 50	$ 428	$ 67
50	31	0	79	3	146	25	247	51	396	75	619	98
60	41	0	103	8	191	41	323	75	518	105	809	132
70	50	1	127	17	235	60	399	98	641	133	1000	164
80	60	1	151	29	280	80	475	123	763	162	1190	196

Site Index — Height, in feet, which dominant trees will attain at 50 years.

Assumed Price of Pulpwood — $4 per cord for standing trees.

Yields — Based on U.S.D.A. Technical Bulletin No. 560, Yield, Stand, and Volume Tables for Even-Aged Upland Oak Forests, by G. Luther Schnur

Costs — Assumed at $1 per year per acre in addition to costs associated with land value at $20 for site index 40, $40 for site index 50, $60 for site index 60, $80 for site index 70, and $100 for site index 80. Interest at 4%.

TABLE 2.—Necessary Value per Cord* for Unharvested Hardwood Pulpwood to Pay Costs of $1 per Acre per Year and 4% Interest on Land (Without Improvement Practices).

Site Class	Age of Stand			
	30	40	50	60
40	$32	$19	$22	$26
50	23	19	21	25
60	18	17	20	25
70	16	16	19	24
80	14	16	19	24

*Since a cord of hardwood pulpwood approximates 2 tons, depending on species involved, the price per ton would be roughly one-half the cord price appearing in this table.

†See footnotes of Table 1 for yield and cost assumptions.

Market value of land on which pulpwood is produced is assumed to be the same after harvest as at the start of production and no charge is made for interest on any value change which may have occurred during the cycle. All of these costs must be exceeded by value of standing trees at harvest time or the owner will lose money on the pulpwood production venture, assuming that the only income is from trees sold for pulpwood.

If production of trees for pulpwood is accompanied by other income, this income can be included in calculating returns. Some such income can be measured but other might be almost impossible to measure in terms of monetary value. However, if the venture is one on which an investor must depend for a portion or all of his income, then only the money returns expected are important in a decision to enter or not enter into such a venture.

LAND COSTS

All land on which timber will grow has some value. Since the aim of this publication is to determine the economic potential of pulpwood production in southeastern Ohio counties, the price for which various qualities of land in that area would sell must be considered.

It is necessary to start with bare land to show the effects of all costs involved in producing pulpwood trees. Assumptions in setting up cost tables are based on bare land values of $20, $40, $60, $80, and $100 per acre. A farm in southeastern Ohio usually consists of land of widely varying values for various productive purposes. This study considers only that part of the land on a farm which logically would not be suitable for crops other than forestry.

YEARLY COSTS

This category includes all costs other than those connected with original investment. It is difficult to imagine any costs per acre of less than $1 per year for even the bare essentials of fencing, taxes, and minimal fire protection. While it might be possible to remove part of the value of the forest land from the tax duplicate, this would amount to a subsidy. Subsidies are not included here as either income or as a cost reducer. Someone must bear these costs and the purpose here is to arrive at the economics of forestry as compared to other ventures, admitting that many other farm ventures are affected by subsidies of one kind or another. The land owner can, if he anticipates them, insert such subsidies in the tables in any way which may affect his venture. This publication shows how the venture would fare on its own, using competitive interest rates.

IMPROVEMENT PRACTICE COSTS AND PRODUCTION EFFECTS

This study assumes improvement practices in preparing the site for a new stand and thinning at appropriate intervals, with clear cutting at the end of the production cycle. Selective cutting occurs only for purposes of thinning to desired stand density. Income from commercial thinnings is inserted in income and cost calculations by their assumed net value. A ready market for the product is assumed to exist. Both preparation costs and pre-commercial thinning costs are calculated at $5 and $10 per acre.

In all tables, cumulated costs are rounded to the nearest dollar.

Estimated yields on hardwood pulpwood stands with improvement practices are assumed as reported in the study by Gansner and Shaudys. These commercial cuts are estimated as follows for the five site classes:

Site class 40:	3 cords at 40th year
	4 cords at 50th year
	23 cords at 60th year (final cut)
Site class 50:	4 cords at 36th year
	5 cords at 45th year
	26 cords at 54th year (final cut)
Site class 60:	5 cords at 32nd year
	6 cords at 40th year
	27 cords at 48th year (final cut)
Site class 70:	6 cords at 28th year
	7 cords at 35th year
	28 cords at 42nd year (final cut)
Site class 80:	6 cords at 24th year
	7 cords at 30th year
	29 cords at 36th year (final cut)

ANALYSIS OF COSTS AND RETURNS

Tables 3 and 4 present the cumulated amounts per acre for costs involved in production of pulpwood for years in which commercial thinning and final harvest are made. These costs are combined in Table 5 to show total costs for years of final harvest. Amounts shown in this table must be realized by cumulated values of sales at final harvest if all costs are to be recovered.

Table 5 also presents a comparison of costs and income at various cost combinations. Income is calculated from a market value of $6 per cord for standing trees. The difference between income and cost becomes more pronounced as interest rates go up because of the effects of compounded costs on land investment and improvement practices. Percent of cost recovered by product sales at $6 per cord would vary from 35% to 68% with interest at 4% and from 22% to 47% with interest at 5%. The best site class (with site class values used in the table) shows the highest percent of recovery because of the shorter time necessary to mature the trees.

The influence of better land on costs (due to more rapid growth) at final harvest is also shown in Table 5. Assignment of land values different than those shown would change the costs accordingly. Land with much higher value than $100 per acre would likely be used for other than forestry purposes.

Cumulated costs in Table 5 are shown only for those years when it is assumed that final harvest would occur for the various site index classes of land.

Comparing income with costs shows rather conclusively that hardwood pulpwood as a crop, with no other income from the land for entire production cycles, would result in a loss to the owner. Since it is obvious that the costs could not be met at prevailing prices for hardwood pulpwood, it is useful to compute product prices necessary to meet the costs. These prices are shown in Table 6.

Again it becomes obvious that income on better grades of land, even with higher land values involved, comes closer to recuperating costs than that from lower grades of land. This is due to the more rapid growth of product on better lands and the effect of compound interest on later years of a production cycle.

Since any price for pulpwood necessary to pay all production costs would be much greater than prevailing prices, it is helpful to calculate the effects of a faster maturing crop with improvement practices on rela-

TABLE 3.—Cumulated Interest Costs per Acre for Land (to Nearest Dollar).

End of Year*	4% Interest					5% Interest				
	Land Value per Acre					Land Value per Acre				
	$20	$40	$60	$80	$100	$20	$40	$60	$80	$100
24	$ 31	$ 63	$ 94	$125	$156	$ 45	$ 89	$ 134	$ 178	$ 223
28	40	80	120	160	200	58	117	175	234	292
30	45	90	135	179	224	66	133	199	266	332
32	50	100	150	201	251	75	151	226	301	376
35	59	118	177	236	295	90	181	271	361	452
36	62	124	186	248	310	96	192	288	383	479
40	76	152	228	304	380	121	242	362	483	604
42	84	168	252	335	419	135	270	406	541	676
45	97	194	290	387	484	160	319	479	639	799
48	111	223	334	446	557	188	376	564	752	940
50	122	244	366	489	611	209	419	628	837	1047
54	146	293	438	585	731	259	518	776	1035	1294
60	190	381	571	762	952	354	707	1061	1414	1768

*Year selected to coincide with years in which commercial thinning or harvest is assumed on various grades of land.

TABLE 4.—Cumulated Costs to Nearest Dollar per Acre for Other Than Land Costs.

End of Year*	4% Interest†					5% Interest†				
	Yearly Costs	Land Preparation Costs		Pre-commercial Thinning at 10th year		Yearly Costs	Land Preparation Costs		Pre-commercial Thinning at 10th year	
	$1	$5	$10	$5	$10	$1	$5	$10	$5	$10
24	$ 39	$13	$ 26	$ 9	$17	$ 45	$16	$ 32	$10	$20
28	50	15	30	10	20	58	20	39	12	24
30	56	16	32	11	22	66	22	43	13	27
32	63	18	35	12	24	75	24	48	15	29
35	74	20	39	13	27	90	28	55	17	34
36	78	21	41	14	28	96	29	58	18	36
40	95	24	48	16	32	121	35	70	22	43
42	105	26	52	18	35	135	39	78	24	48
45	121	29	58	20	39	160	45	90	28	55
48	139	33	66	22	44	188	52	104	32	64
50	152	36	71	24	48	209	57	115	35	70
54	183	42	83	28	56	259	70	139	43	86
60	238	53	105	36	71	354	93	187	57	115

*Years at which either a commercial thinning or harvest is assumed to be made.

†Interest on yearly recurring costs is assumed from end of years of outlay. For preparation costs, interest is assumed to occur from date of preparation. Pre-commercial thinning was assumed to occur at same time of year as commercial thinning or harvest.

TABLE 5.—Cumulated Costs and Income per Acre for Various Combinations of Costs at Final Harvest.

Year of Harvest	Interest Rate	Costs: $1 Yearly Cost, $5 Preparation, $5 Thinning	Costs: $ 1 Yearly Cost, $ 5 Preparation, $10 Thinning	Costs: $ 1 Yearly Cost, $10 Preparation, $ 5 Thinning	Costs: $ 1 Yearly Cost, $10 Preparation, $10 Thinning	Income: $6 per cord Stumpage
			Site Class 40 — $20 Land Value			
60	4 %	$517	$552	$569	$ 604	$212.94
	5 %	858	916	952	1010	224.85
			Site Class 50 — $40 Land Value			
54	4 %	546	574	587	615	247.20
	5 %	890	933	959	1002	265.50
			Site Class 60 — $60 Land Value			
48	4 %	528	550	561	583	267.16
	5 %	836	868	888	920	280.68
			Site Class 70 — $80 Land Value			
42	4 %	484	501	510	527	285.60
	5 %	738	762	777	801	298.35
			Site Class 80 — $100 Land Value			
36	4 %	423	437	443	457	284.76
	5 %	622	640	651	669	294.91

tion of income to expenses.[8] For this purpose, the following assumptions are made. First, only land of site index value of 80 could qualify for fast maturity of trees. Second, it is assumed that it would be possible to produce the same volume in total as was estimated for this site class at 36 years. Third, the first commercial thinnings would be made earlier and be of the same quantity as thinnings for the 36-year cycle.

[8]No studies have been made concerning the elasticity of demand for or supply of pulpwood—either at the standing tree level or at the mill. By far the greater part of the cost of pulpwood is in the harvesting and delivery cost, which indicates there would be complications in calculating elasticities. No real test of the demand for the unharvested product will come as long as the supply is more than adequate, as indicated by production compared to use by mills. Supply seems to be more a function of production on land which is not economically suitable for production of other farm products than that of a function of price offered.

TABLES 6.—Price per Cord* for Standing Trees Necessary to Pay Cumulated Costs for Full Cutting Cycle.

Yearly Costs per Acre	Land Preparation Cost	Thinning Cost at 10 Years	Price per Cord	
			4% Interest	5% Interest
		Site Class 40 — $20 per Acre		
$1	$ 5	$ 5	$14.57	$22.90
1	5	10	15.55	24.45
1	10	5	16.03	25.41
1	10	10	17.02	26.96
		Site Class 50 — $40 per Acre		
1	5	5	13.25	20.11
1	5	10	13.93	21.09
1	10	5	14.24	21.67
1	10	10	14.92	22.64
		Site Class 60 — $60 per Acre		
1	5	5	11.98	17.87
1	5	10	12.48	18.55
1	10	5	12.73	19.00
1	10	10	13.23	19.66
		Site Class 70 — $80 per Acre		
1	5	5	10.16	14.84
1	5	10	10.52	15.33
1	10	5	10.71	15.63
1	10	10	11.07	16.11
		Site Class 80 — $100 per Acre		
1	5	5	8.91	12.65
1	5	10	9.20	13.02
1	10	5	9.33	13.24
1	10	10	9.63	13.61

*Yields based on preliminary unpublished findings of Northeastern Forest Experiment Station.

Using these assumptions, it was found that an assumed production cycle of 24 years (with commercial thinnings of 6 cords at year 12 and 7 cords at year 18 and final harvest of 29 cords at year 24) would yield a slight profit, with product value at $6 per cord and interest at 4%. This would be true at all cost combinations as assumed and shown in Table 5. The profit would vary from $68 per acre for the entire production cycle with lowest combinations of cost, to $47 per acre at highest combinations considered.

With pulpwood at $6 per cord and interest at 5%, a loss of $9 per acre would occur with lowest cost combinations and a $35 per acre loss would occur with highest cost combinations. At $4 per cord, losses would be incurred with all cost combinations considered for a 24-year maturity cycle. At $5 per cord, a slight profit would occur with interest at 4%, but at 5% interest a loss of $33 to $60 per acre would occur.

These calculations are not a prediction but merely serve to show what shorter production cycles might accomplish when and if possible without adverse yield effect.

OTHER INCOME

There are no doubt instances where pulpwood stand owners may value the area for uses in addition to income from pulpwood. The amount of other income per year necessary to equate the total income to expenses is shown in Table 7. This *other* income might be from several actual dollar income possibilities or from value of satisfaction in use for recreation by the family. Only the owner can calculate or estimate such income. Table 7 merely gives the necessary amount per acre per year to add to pulpwood value so that total costs are met over the complete cycle on various grades of land. It is assumed that this added income is equal each year from start of stand and has compound value the same as any other income.

Much work needs to be done to develop some kind of income from land used for pulpwood production and other forest products to help defray costs involved in the long cycles of production. Evidently satisfaction in ownership furnishes a psychic income to some owners but in many cases this is not present. Development of additional uses of such land during the production cycle would be very helpful in making ownership profitable.

TABLE 7.—Yearly Income per Acre in Addition to Pulpwood Sales Necessary to Meet All Costs for Complete Growth Cycle.

Land Value*	Stumpage Price per Cord	Lowest Expense† 4% Interest	Lowest Expense† 5% Interest	Highest Expense‡ 4% Interest	Highest Expense‡ 5% Interest
Site Index 40					
$20 (60-year cycle)	$3.00	$1.72	$2.11	$2.09	$2.54
	4.00	1.58	2.00	1.94	2.43
	6.00	1.28	1.79	1.65	2.22
Site Index 50					
$40 (54-year cycle)	3.00	2.31	2.92	2.65	3.36
	4.00	2.10	2.75	2.45	3.20
	6.00	1.63	2.41	2.01	2.84
Site Index 60					
$60 (48-year cycle)	3.00	2.83	3.70	3.23	4.15
	4.00	2.53	3.40	2.92	3.90
	6.00	1.87	2.94	2.27	3.39
Site Index 70					
$80 (42-year cycle)	3.00	3.25	4.36	3.66	4.83
	4.00	2.80	4.00	3.21	4.46
	6.00	1.90	3.25	2.32	3.71
Site Index 80					
$100 (36-year cycle)	3.00	3.60	4.94	4.03	5.37
	4.00	3.00	4.43	3.43	4.92
	6.00	1.78	3.41	2.22	3.90

*Values used here are the same as for the five site classes used in other tables where land value is considered.

†Lowest expense considered was $1 yearly outlay, $5 land preparation, and $5 pre-commercial thinning.

‡Highest expense considered was $1 yearly outlay, $10 land preparation, and $10 pre-commercial thinning.

CONCLUSIONS

This study yields no evidence that the production of hardwood pulpwood, as a complete production cycle venture and at prevailing prices, offers a chance for profit to the owner from sale of pulpwood alone. Prices per cord would have to be so much higher than those prevailing at present that pulpwood production cannot be considered as an economic venture unless income in addition to that from pulpwood can be realized.

This is not to say that pulpwood stands partly grown cannot yield a profit when past expenses are excluded. Land owners with a stand of pulpwood trees would need to look at the costs and returns involved from the present to final harvest to determine possible profits. Once the harvest is completed, pulpwood production feasibility must be treated as a complete cycle venture.

For the future there are two variables which could enter to make pulpwood production profitable in Appalachian counties of Ohio. These two variables are separate from concerns with generating supplementary income from the land devoted to its production.

One factor would be a very substantial increase in price of the product and another is in development of more rapid growth of the trees. Product price would have to be so much higher that this avenue seems to hold little possibility. The second factor, more rapid growth, seems to offer more possibility, but development of sufficient import to result in a profit would take considerable time. Surely with such rapid advance in technology as obtained in so many areas, some way can eventually be found to speed up tree growth sufficiently to result in profitable production at somewhere near present prices.

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